

What is claimed is:

1. A system for delivering material onto a substrate, said system comprising:
a jetting assembly comprising:

5 a reservoir containing the material, said reservoir having a nozzle through which
the material is expelled from the reservoir;

an arcuate section positioned between the reservoir and the nozzle, wherein the
material is configured to travel from the reservoir, through the arcuate section, and through the
nozzle;

10 a means for applying pressure on the material contained in the reservoir, wherein
the material is expelled from the reservoir through application of pressure by the means for
applying pressure to thereby create a column of the material from the nozzle; and

a means for producing pressure modulations located proximate the nozzle, the
means for producing pressure modulations being configured to substantially regulate formation of
droplets from the column of the material;

15 a charging ring, wherein said droplets are configured to pass through the charging ring,
and wherein the charging ring is configured to induce an electrical charge to selective ones of the
droplets; and

one or more deflection plates for altering a trajectory of the charged droplets.

20 2. The system according to claim 1, wherein said arcuate section is configured to
substantially prevent drying of the material in the nozzle.

3. The system according to claim 1, further comprising:
a support plate configured to support one or both of the substrate and the jetting assembly.

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4. The system according to claim 3, wherein said support plate is configured to move
in two or more dimensions to thereby move the substrate.

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5. The system according to claim 3, further comprising:

an electrostatic potential delivery device for delivering electrostatic potential to the support plate, wherein delivery of electrostatic potential to the support plate operates to vary the velocities at which the droplets impact the substrate.

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6. The system according to claim 1, further comprising:

a collection plate positioned between the one or more deflection plates and the substrate, said collection plate being configured to receive unwanted droplets, and wherein said collection plate is configured to direct received droplets to at least one of a waste area and the reservoir.

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7. The system according to claim 6, wherein the one or more deflection plates are configured to alter the trajectories of unwanted droplets into the collection plate.

8. The system according to claim 1, wherein the one or more deflection plates are

15 configured to alter the trajectories of the droplets to various sections of the substrate.

9. The system according to claim 1, further comprising:

a heating mechanism configured to supply heat to the material contained in the reservoir.

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10. The system according to claim 1, wherein the material comprises one or more of a semiconductor material, a metal, a dielectric, a passivation material, a protective coating material, an etchant, a dopant, and a reactant.

11. The system according to claim 1, wherein the reservoir comprises a re-filling

25 device configured to enable material to be inserted into the reservoir.

12. The system according to claim 1, wherein the reservoir comprises a separate component and wherein the reservoir is separately replaceable.

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13. The system according to claim 1, further comprising:
a controller for controlling the means for applying pressure, the means for producing pressure modulations, the charging ring and the deflection plates;

5 14. The system according to claim 1, wherein the means for producing pressure modulations comprises a PZT transducer.

15. The system according to claim 1, further comprising:
a plurality of jetting assemblies;
10 a plurality of charging rings, wherein droplets from the plurality of jetting assemblies are configured to pass through respective ones of the plurality of charging rings; and
a plurality of deflection plates for altering the trajectories of the droplets from respective ones of the jetting assemblies.

15 16. The system according to claim 15, wherein the plurality of jetting assemblies contain different materials with respect to each other.

17. The system according to claim 15, wherein the plurality of jetting assemblies are positioned to substantially simultaneously deposit material onto the substrate.

20 18. A method for depositing a material onto a substrate, said method comprising:
applying a pressure onto a material located in a reservoir, wherein said pressure causes the material to flow through a arcuate section and out of a nozzle in a fluid column;
creating pressure modulation through the fluid column to control formation of droplets
25 from the fluid column, wherein the droplets travel along a flight path from the fluid column;
electrically charging one or more of the droplets; and
varying the flight path of at least one of the one or more charged droplets.

30 19. The method according to claim 18, wherein the step of varying the flight path of at least one of the one or more charged droplets comprises inducing an electrostatic potential on the at least one of the one or more charged droplets to vary the flight path.

20. The method according to claim 18, further comprising:
determining whether at least one of the one or more charged droplets are to be discarded;
and

wherein the step of varying the flight path of at least one of the one or more charged
5 droplets comprises varying the flight path of one or more charged droplets to be discarded to
direct the one or more charged droplets to be discarded to a collection plate.

21. The method according to claim 18, wherein the step of varying the flight path of at
least one of the one or more charged droplets comprises varying the flight path of at least one of
10 the one or more charged droplets having a charge/mass ratio falling outside of a predetermined
charge/mass ratio range.

22. The method according to claim 18, further comprising:
determining one or more positions on the substrate for the one or more droplets to
15 impact; and
directing at least one of the one or more droplets to impact the one or more positions on
the substrate.

23. The method according to claim 18, further comprising:
20 determining whether a trajectory of the at least one of the one or more droplets is to be
altered; and
wherein the step of directing the at least one of the one or more droplets to impact the one
or more positions comprises varying the trajectory of the at least of the one or more droplets to
vary the position of impact of the at least one of the one or more droplets on the substrate.

25 24. The method according to claim 18, further comprising:
determining one or more positions on the substrate for the one or more droplets to impact;
determining whether the substrate is to be moved to cause the one or more droplets to
impact the one or more positions; and
30 moving the substrate in response to a determination that the substrate is to be moved to
cause the one or more droplets to impact the one or more positions.

25. The method according to claim 18, further comprising:
determining one or more positions on the substrate for the one or more droplets to impact;
determining whether a trajectory of the at least one of the one or more droplets is to be
altered and whether the substrate is to be moved to cause the one or more droplets to impact the
5 one or more positions; and
altering the trajectory of the at least one of the one or more droplets and moving the
substrate to cause the one or more droplets to impact the one or more positions.

26. The method according to claim 18, further comprising:
10 depositing the one or more droplets onto the substrate;
determining whether a velocity at which the one or more droplets are deposited onto the
substrate is to be altered prior to the step of depositing the one or more droplets onto the
substrate; and
altering the velocities of the one or more droplets in response to a determination that the
15 velocities at which the one or more droplets are deposited onto the substrate are to be altered.

27. The method according to claim 26, further comprising:
applying an electrostatic charge having the same polarity as the electrical charge of the
one or more droplets to decrease the velocities of the one or more droplets; and
20 applying an electrostatic charge having a different polarity than the electrical charge of the
one or more droplets to increase the velocities of the one or more droplets.

28. The method according to claim 18, wherein the step of creating pressure
modulations through the fluid column comprises creating acoustic waves with a PZT transducer.
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29. The method according to claim 18, wherein the step of applying a pressure onto a
material comprises applying a substantially uniform pressure onto the material.

30. The method according to claim 18, further comprising:
30 re-filling the reservoir with one or more of the material and a different material.

31. The method according to claim 18, further comprising:
replacing the reservoir with one or more of a reservoir containing the material and a reservoir containing a different material.

5 32. A system for delivering material onto a substrate, said system comprising:
means for housing the material;
means for applying pressure on the material;
means for expelling the material from the means for housing the material;
means for channeling the material from the means for housing to the means for expelling
10 the material, wherein the means for channeling the material comprises an arcuate shape;
means for creating substantially uniform droplets from a column of material expelled
from the means for expelling the material; and
means for selectively charging the droplets.

15 33. The system according to claim 32, wherein the means for creating substantially
uniform droplets comprises means for producing pressure modulations in the column of material.

34. The system according to claim 32, further comprising:
means for heating the material housed in the means for housing.

20 35. The system according to claim 32, further comprising:
means for deflecting one or more of the charged droplets.

36. The system according to claim 32, further comprising:
25 means for moving the substrate in along at least one dimensional plane.

37. The system according to claim 36, wherein the means for moving the substrate
comprises means for applying an electrostatic charge to the support plate to vary the velocity of
the charged droplets approaching the substrate.

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38. The system according to claim 32, further comprising:
means for re-filling the reservoir with one or more of the material and a different material.

39. A computer readable storage medium on which is embedded one or more
5 computer programs, said one or more computer programs implementing a method for depositing
a material onto a substrate, said one or more computer programs comprising a set of instructions
for:

applying a pressure onto a material located in a reservoir, wherein said pressure causes the
material to flow through an arcuate section and out of a nozzle in a fluid column;

10 creating pressure modulation through the fluid column to control formation of droplets
from the fluid column, wherein the droplets travel along a flight path from the fluid column;

electrically charging one or more of the droplets; and

varying the flight path of at least one or more charged droplets.

40. The computer readable storage medium according to claim 39, said one or more
15 computer programs further comprising a set of instructions for:

determining whether at least one of the one or more charged droplets are to be discarded;
and

20 wherein the step of varying the flight path of at least one of the one or more charged
droplets comprises varying the flight path of one or more charged droplets to be discarded to
direct the one or more charged droplets to be discarded to a collection plate.

41. The computer readable storage medium according to claim 39, said one or more
computer programs further comprising a set of instructions for:

25 determining one or more positions on the substrate for the one or more droplets to impact;
and

directing at least one of the one or more droplets to impact the one or more positions on
the substrate.

42. The computer readable storage medium according to claim 39, said one or more computer programs further comprising a set of instructions for:

determining whether a trajectory of the at least one of the one or more droplets is to be altered; and

5 wherein the step of directing the at least one of the one or more droplets to impact the one or more positions comprises varying the trajectory of the at least one of the one or more droplets to vary the position of the at least one droplet on the substrate.

43. The computer readable storage medium according to claim 39, said one or more computer programs further comprising a set of instructions for:

determining one or more positions on the substrate for the one or more droplets to impact; determining whether the substrate is to be moved to cause the one or more droplets to impact the one or more positions; and

10 moving the substrate in response to a determination that the substrate is to be moved to cause the one or more droplets to impact the one or more positions.

44. The computer readable storage medium according to claim 39, said one or more computer programs further comprising a set of instructions for:

determining one or more positions on the substrate for the one or more droplets to impact; 20 determining whether a trajectory of the at least one of the one or more droplets is to be altered and whether the substrate is to be moved to cause the one or more droplets to impact the one or more positions; and

altering the trajectory of the at least one of the one or more droplets and moving the substrate to cause the one or more droplets to impact the one or more positions.

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45. The computer readable storage medium according to claim 39, said one or more computer programs further comprising a set of instructions for:

depositing the one or more droplets onto the substrate;

determining whether a velocity at which the one or more droplets are deposited onto the substrate are to be altered prior to the step of depositing the one or more droplets onto the substrate; and

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altering the velocities of the one or more droplets in response to a determination that the velocities at which the one or more droplets are deposited onto the substrate are to be altered.

46. The computer readable storage medium according to claim 45, said one or more
5 computer programs further comprising a set of instructions for:

applying an electrostatic charge having the same polarity as the electrical charge of the one or more droplets to decrease the velocities of the one or more droplets; and

applying an electrostatic charge having a different polarity than the electrical charge of the one or more droplets to increase the velocities of the one or more droplets.

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